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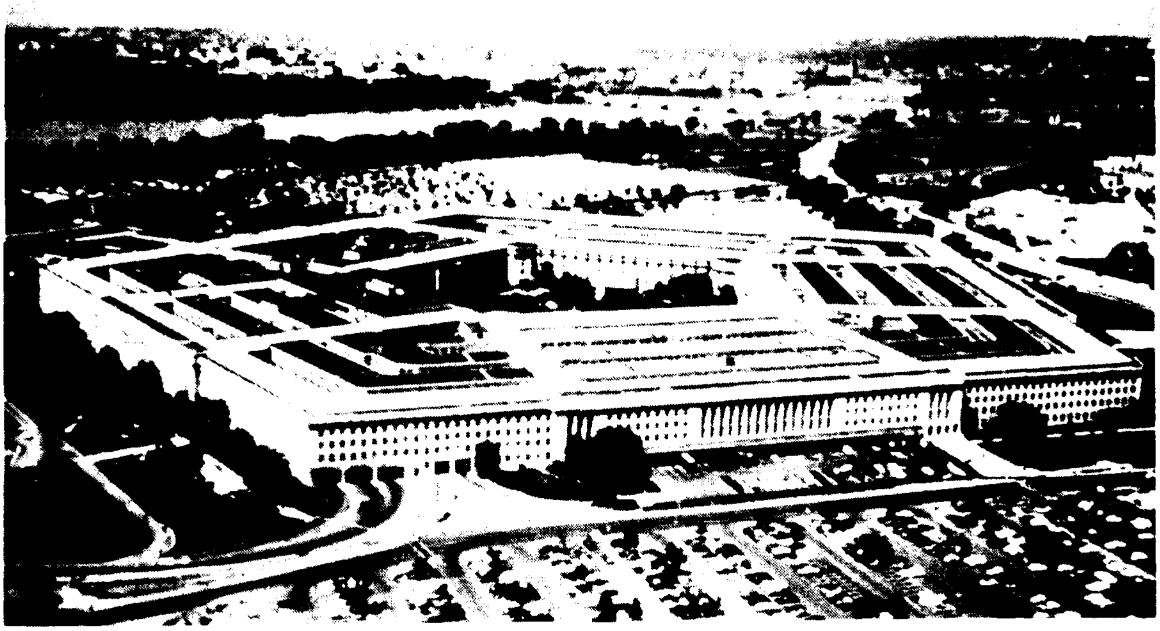
Proactive Maintenance Planning for Historic Buildings

by
Frederick J. Rushlow
Don Kermath



The Department of Defense is the largest steward of historic buildings in the United States. Because important architectural attributes may be lost forever due to postponed or incomplete maintenance, preserving the nation's rich military architectural history depends heavily on the application of a thorough and well designed proactive maintenance plan (PMP). The proactive approach to maintaining historic buildings includes preservation planning, preventive maintenance, and documentation of historic buildings. A PMP can be tailored to each historic building to be maintained.

This report discusses proactive maintenance, the components of a PMP, and their importance to the preservation of military historic buildings. The report also provides installation cultural resource managers with technical information about the care and maintenance of historic buildings.

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The Department of Defense is the largest steward of historic buildings in the United States. Because important architectural attributes may be lost forever due to postponed or incomplete maintenance, preserving the nation's rich military architectural history depends heavily on the application of a thorough and well designed proactive maintenance plan (PMP). The proactive approach to maintaining historic buildings includes preservation planning, preventive maintenance, and documentation of historic buildings. A PMP can be tailored to each historic building to be maintained.

This report discusses proactive maintenance, the components of a PMP, and their importance to the preservation of military historic buildings. The report also provides installation cultural resource managers with technical information about the care and maintenance of historic buildings.

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Foreword

This research was conducted for the U.S. Army Office of the Assistant Chief of Staff for Installation Management (OACS(IM)) under military interdepartmental purchase order E87910301, dated 28 January 1991; Legacy Resource Management Program Project 45, "Develop Guide for Maintenance of Historic Buildings." The technical monitor was Dr. Constance Ramirez, DAIM-ED-N.

The work was performed through the Tri-Services Cultural Resources Research Center by the Facility Management Division (FF) of the Infrastructure Laboratory (FL), U.S. Army Construction Engineering Research Laboratories (USACERL). Alan W. Moore is Acting Chief, CECER-FF, and Dr. Michael J. O'Connor is Chief, CECER-FL. The USACERL technical editor was Gordon L. Cohen, Information Management Office.

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Tri-Services Cultural Resources Research Center

The Tri-Services Cultural Resources Research Center is a research and technical support center that assists the U.S. military services in the stewardship of cultural resources located within Department of Defense (DoD) installations or facilities. The Center, located at USACERL, helps installations manage their cultural resources and comply with Federal, State, and DoD preservation mandates.

The Legacy Resource Management Program was established by Congress in 1991 to promote, manage, research, conserve, and restore the biological, geophysical, and historic resources on public lands, facilities, or properties under DoD stewardship. Legacy allows DoD to determine how to better integrate the conservation of these resources with the requirements of the military mission. Legacy activities help to ensure that DoD personnel better understand the need for protection and conservation of natural and cultural resources, and that the management of these resources support, DoD mission activities and the public interest.

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1 Introduction

Background

The Department of Defense (DoD) is the largest steward of historic buildings in the United States. DoD operates more than 10,000 historic buildings, and the number grows every year. Because all structures deteriorate over time, and because important architectural attributes may be lost forever due to postponed or incomplete maintenance, preserving the nation's rich military architectural history depends heavily on the application of a thorough and well designed proactive maintenance plan (PMP).

Responsibility for the PMP is assigned to the installation cultural resource manager (CRM), who is tasked with promoting historic-building awareness and ensuring that historic structures will survive for future generations. The proactive approach to maintaining historic buildings includes preservation planning, preventive maintenance, and documentation of historic buildings. A PMP can be tailored to each historic building to be maintained. Essential to a PMP is flexibility, due to the assortment of historic buildings on installations across the country.

The premise of proactive maintenance is to prevent deterioration:

> All objects are in the process of change .... Organic materials such as wood, paint and asphalt deteriorate, returning to the earth to nourish the currently growing crop of organic materials. Many inorganic building materials try to change from the refined state back to the original oxide, such as rust; other materials, such as stone, which are already oxides, wear away as the result of abrasion, freezing and thawing, etc. (Chambers 1976)

The term *proactive* means to act in anticipation of an expected event. In a PMP, building deterioration is the expected event. A PMP may be described as the preparation, intervention, and control of historic building deterioration. It incorporates a diverse group of preservation activities to anticipate and avoid the deterioration and failure of building components (e.g., roofs, windows, porches).

In a well executed PMP, personnel intervene with maintenance resources before a building component fails. The PMP's goal is to control building deterioration rather than reacting to it.

A well designed PMP includes natural disaster planning and procedures for building layaway. Natural disaster planning prepares for uncontrollable forces of nature. Layaway planning is intended to preserve the integrity of historic facilities that are "mothballed" as a result of base realignment, closure, etc.

Relevance to DoD

A proactive approach to historic building maintenance is important to DoD in three primary ways: economics, stewardship, and regulatory compliance.

Building maintenance represents a substantial expense for most military installations. Prevention of building failures is ultimately less expensive than repairing them after the fact. Although Figure 1 shows an increase in cost at the beginning of a PMP, the costs reach a peak, then decline as component, equipment, and system failures become less frequent. Savings begin at the point where PMP costs fall below the expenses incurred in the original reactive maintenance program. The result is perpetual new savings on maintenance. These savings can fund expansion of the PMP or can be used to reduce the installation's building maintenance operations budget (Matulionis and Freitag 1991).

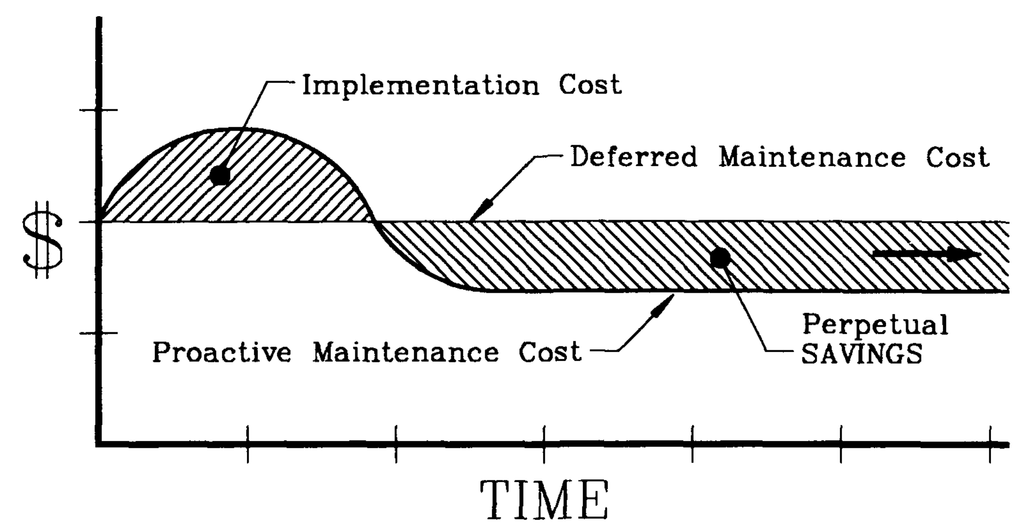

Figure 1. Long-Term Savings Through Proactive Maintenance.

Stewardship of military cultural resources is a high priority for DoD. Historic military properties are especially significant as living examples of historic military design and engineering. Military installations have always played an important role in the safety and security of the United States (Uzarski 1992). Furthermore, many installations are closely associated with important historic figures, including political leaders, military leaders, and soldiers. Historic facilities are not important only for their architectural value, then—some may be considered as monuments to historic personalities and events. As the pioneer preservationist John Ruskin wrote:

> Take proper care of your monuments, and you will not need to restore them. A few sheets of lead put in time upon the roof, a few dead leaves and sticks swept in time out of a water-course, will save both roof and walls from ruin (Ruskin 1849).

DoD properties are required to comply with numerous laws and regulations governing the treatment, maintenance, and repair of historic buildings. Important examples include:

- *The National Historic Preservation Act of 1966*, as amended (PL 89-665).
- *Protection and Enhancement of the Cultural Environment* (36 CFR 8921; 16 USC 470).
- *Identification Procedures, Protection and Enhancement of Historic and Cultural Properties* (36 CFR 32).
- *Procedures for the Protection of Historic and Cultural Properties* (36 CFR 800).

Failure to comply with such regulations could undermine DoD's stewardship of its cultural resources and interfere with mission-related activities.

Objectives

The objectives of this research are to:

- explain proactive maintenance, its components, and their importance to the preservation of military historic buildings
- provide CRMs with technical information about the care and maintenance of historic buildings
- serve as a PMP resource and reference tool for CRMs
- provide a foundation for future studies of how to integrate proactive maintenance for historic buildings into existing installation maintenance programs.

Approach

A literature search was conducted to cover the topics of proactive and preventive maintenance, and historic facilities. A process map was composed to describe a general PMP for historic

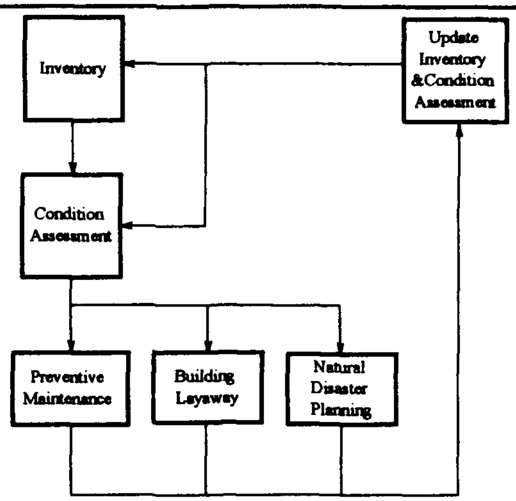

Figure 2. General Process Map for a PMP.

military structures (Figure 2), and a report was drafted to include a chapter explaining each main step of the process. The draft report was reviewed at an April 1993 conference of the Historic Facilities Maintenance Management Advisory Group, an interdisciplinary group of historic preservation professionals, managers, and policymakers from government, private-sector organizations, and academia. The group's review comments were then incorporated into this final report.

Scope

This report does not address the criteria used to determine a building's historical significance; it is assumed that the information published here will be applied to structures already determined to be historically significant.

Discussion of specific repair and proactive maintenance techniques is beyond the scope of this report, and construction management methods for historic building renovation are not addressed.

2 Management Tools

Description

A PMP uses three key management tools for the effective and efficient care of historic buildings:

- historic building inventories (HBI)
- condition assessment (CA)
- computer applications.

HBIs and CAs are an integral part of any PMP. Computer applications are not a distinct step in the PMP process; computers are an important tool for managing a PMP. Figure 3 shows how management tools fit into the PMP.

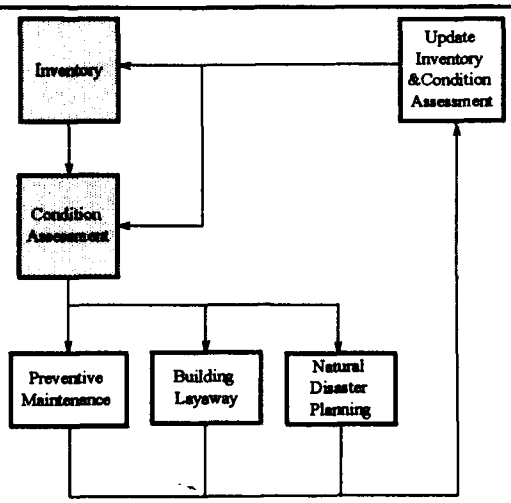

Figure 3. Management Tools Flowchart.

Building Inventory

An HBI is a catalog of a historic structure's building materials, components, systems, and interior contents. The historic significance of each recorded element is evaluated. Adjacent landscapes are also inventoried. HBIs and condition assessments information are the foundation and framework for all subsequent PMP activities. HBIs and CAs can be performed separately or in coordination with one another.

An HBI should be prepared by an expert in past and present building trades, means, and methods. The inventory should be updated when a building or its contents change. It is recommended that a complete HBI be done every 5 years or sooner, depending on the site. Such periodic reviews provide a way to track inventory trends and changes.

The organization and detail of an HBI should serve the installation it represents. There is no one right way to conduct or format an HBI. If a single standard format were established, however, it would greatly improve the transfer and storage of HBI information. Installation size, building types and numbers all play a role in structuring HBIs. It is also important for HBIs to be easy to understand and use. Therefore, the preparers, maintainers, and users of HBI records must be considered. The following guidelines apply:

- be clear and thorough when recording information, to ensure the report's usefulness
- use uniform terms, notations, and abbreviations to avoid confusion
- comply with the guidelines for registration into the National Register of Historic Places (National Park Service, December 1987).

A useful reference for preparing an inventory is the USACERL Technical Report (TR) CRC-94/03, *Guidelines for Documenting Historic Military Structures*, by Susan I. Enscore, Dan R. Lapp, and Mira D. Metzinger (March 1994).

Exterior Inventory

A building's exterior inventory should include a description of the building, a record of the building materials used, treatments, and their historic significance. Sketches and photographs of building elevations and roofs (with notes) should accompany the written information. The locations of electrical meters, water meters, and other building systems should also be clearly marked on the elevation sketches and photographs.

Interior Inventory

A building's interior inventory should follow the same format used for the exterior inventory. Additions for the interior inventory may include a section for interior contents (furnishings, wall hangings, and window or wall coverings) and a building systems section (plumbing, electrical, heating, and air conditioning). Interior elements should be cataloged noting their location in the building (e.g., west wall, ceiling, floor, room, floor level, wing). Room and floor sketches and photographs are helpful in clarifying written information.

Historic Significance

Determining historic significance is not within the scope of this report. However, questions about historic significance may arise during inventory. The State Historic Preservation Officer, the National Advisory Counsel on Historic Preservation, and local or installation historical societies are all good places to look for assistance. The National Park Service and The National Trust for Historic Preservation both have published extensive information on this subject as well.

For purposes of this report, it is assumed that a building's historic significance has previously been determined. The following is an example of a coding system that may be used to note the significance of recorded building materials, components, and systems:

H — historic material original to the facility

O — old material from another facility

N — new material (such as new plaster repairing a hole in an original wall)

R — reproduction material (such as wallpaper reproduced to match original wallpaper)

S — modern substitutes (such as fiberglass replacement of stone cornices).

Other Items To Include

Other useful information to include in an HBI would be:

- reproducible construction documents
  - — specifications (two copies, a working copy, and a record copy)
  - — construction drawings
- as-built drawings
- Historic American Building Survey (HABS) and Historic American Engineering Record (HAER) drawings
- photographs (current and historic)
- materials and material samples
- manufacturers' data

- landscape records
  - — drawings and maps of utilities, streets, and infrastructure
  - — right-of-ways, easements, and restrictive covenants
  - — topography maps
  - — soil analysis
  - — ground cover maps and records (trees, shrubs, grass)
  - — records of previous geological and archeological activities
- information about the architect/designer and contractor
- a description of the original construction and year of its completion
- newspaper and magazine clippings
- active warranties, bonds, guarantees, and historic documents.

Record and Sample Storage

Accessibility is the key to inventory information storage. Very often, critical information cannot be found or accessed—or when finally found, it is no longer in a usable condition. Records, documents, and samples should be organized and updated regularly in a central location. This storage space should be securely protected and environmentally controlled. HBI information is valuable enough to justify strict control of its removal from the storage area. Original legal documents such as surveys, bonds, and guarantees should be kept in a secure place, and copies should be made for maintenance uses. The 13 area Federal Records Centers of the National Archives and Records Administration can offer guidance on records storage. (The address for the Washington Center is: Washington National Records Center, Washington, DC 20409, telephone 301-763-7005.) Additional procedures for the care of original archival documents is available from the appropriate State Historic Preservation Office or HABS/HAER offices. Both agencies have published extensively on the archival storage of documents. Another valuable reference on this topic is the *Museum Handbook, Part I – Museum Collections* (National Park Service, September 1990), which also provides extensive guidance on all aspects of managing collections.

Paper records, documents, and other miscellaneous information can be stored in hardcover binders, filing cabinets, or other protective devices. Manufacturer's data is typically stored at the point of repair for installed building systems. This information needs to be protected from grease, dirt, and moisture by a plastic laminate cover. The original document should be securely stored in the facility's record-storage area.

New paint samples for matching colors should be made on high-quality watercolor paper, rather than plywood. Paint samples on letter-size paper can be placed in notebooks. Note that the gloss characteristics of paint on absorbent paper may be different than for hard surfaces. Polaroid prints are chemically unstable, and should be copied using a more stable photographic process.

Storage space should also be provided for larger, more cumbersome materials and samples. Architectural drawings, if not stored on microfilm or microfiche, should be stored flat in drawers or hung in a cabinet designed for that purpose. Fragile samples should be kept in individual acid-free containers with protective packing, and clearly labeled for easy reference. Heavy samples (e.g., stone) should not weigh more than 4 lb* per storage container.

The need for additional storage space should be acknowledged and planned for as the inventories grow.

Building Use Planning

Building use planning is critical in preserving historic military buildings. Each historic property should be recognized as a physical record of its time, place, and use. Some buildings change over time, and these changes can acquire historic significance in their own right. Such changes should be retained and preserved. Changes that create a false sense of historical development, such as adding conjectural architectural elements from other buildings, are not recommended. The insensitive use of such elements can result in irreversible damage to the historic integrity of a building.

A building use plan is created to serve an installation and its mission. In doing so, however, it must be sensitive to the historic value of buildings. Information collected in HBIs and condition assessments can help to ensure that historic facilities are appropriately addressed in the plan. Such building use plans are invaluable in planning PMP activities in preventive maintenance, building layaway programs, and preparedness plans for natural disasters. For example, a historic woodshop has different PMP needs than a historic library.

Condition Assessment

The condition assessment, or CA, is an evaluation of a historic building's physical condition. Building elements are surveyed and assigned a condition ranking and life-expectancy estimate. A condition-ranking scale (e.g., good, fair, poor) is used to grade the physical condition of building materials, components, and systems. A life-expectancy estimate is an estimate of the time remaining before a surveyed building element will have to be replaced. CAs also identify special considerations noted during a building evaluation. Such concerns might include excessive wear in public areas of the building or possible problems with fire exits.

As noted earlier, CAs and HBIs may be performed separately or in coordination with one another. This is possible because CAs use an inventory process to collect building condition information. As in an HBI, a CA should be prepared by an expert in past and present building trades, materials, and methods. A CA should be updated as the physical condition of the historic buildings changes. It is recommended that a complete CA be done every 5

*1 lb = 0.453 kg

years or another cycle more appropriate to the site. Such cycles keep the CA current and help measure the success rate of PMPs.

A building CA report is an essential tool for correctly planning successful PMP activities in preventive maintenance, repair, building layaway, and natural disasters planning. When the physical condition of a building's materials, components, and systems is known, CA reports can be used to help assess the annual progress in PMP activities.

The Code of Federal Regulations (CFR) provides guidance for assessing the effect that PMP activities have on historic facilities. These regulations are relevant to all historic facilities because they focus on qualifying facilities for inclusion in the National Register for Historic Places (NRHP). The regulations are as follows:

- 36 CFR 800.9 (a) Effect on Historic Buildings.

  An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register. For the purpose of determining effect, alteration to features of a property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered.

- 30 CFR 800.9 (b) Criteria of Adverse Effect.

  An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include, but are not limited to:

  (1) Physical destruction, damage, or alteration of all or part of the property (ex: cutting off brackets, projecting window and door surrounds, etc., and covering the building with vinyl siding);

  (2) Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register (ex: building storage facilities on a central, prominent parade ground, thus altering the character of the area and reducing the significance of buildings which surround the parade ground);

  (3) Introduction of visual, audible, atmospheric elements that are out of character with the property or alter its setting (ex: replacement of a clay tile roof with composition shingles);

  (4) Neglect of a property resulting in its deterioration or destruction (ex: failure to maintain, repair, or periodically inspect a historic building due to lack of funds or personnel); and

  (5) Transfer, lease, or sale of the property.

- 36 CFR 800.9 (c) Exceptions to the Criteria of Adverse Effect.

Effects of an undertaking that would otherwise be found to be adverse may be considered as being not adverse for the purpose of these regulations:

(1) When the historic property is of value only for its potential contribution to archeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines;

(2) When the undertaking is limited to the rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of affected property through conformance with the Secretary's "Standards for Rehabilitation and guidelines for Rehabilitating Historic Buildings"; or

(3) When the undertaking is limited to the transfer, lease, or sale of a historic property, and adequate restrictions or conditions are included to ensure preservation of the property's significant historic features.

Evaluation of Findings

When applying the criteria of effect and adverse effect, there are three possible findings:

- No effect: there is no effect of any kind (neither harmful nor beneficial) on the historic properties.
- No adverse effect: there could be an effect, but it would not be harmful to those characteristics that qualify the property for inclusion in the National Register.
- Adverse effect: there could be an effect that could diminish the integrity of such characteristics.

Computer Applications

Managing the repair and preservation of historic buildings involves the management of large quantities of information. The amount of information increases yearly as new data are generated over a building's operating life. For a historic site comprising hundreds of buildings, the situation can become overwhelming as thousands of new pieces of information about the site's condition and maintenance can be generated in a single year. The ability to effectively maintain and analyze all this information directly affects the ability to manage maintenance activities at the site.

While it is certainly possible to use a manual filing system to manage large amounts of information, there comes a point when excessive amounts of information makes computer automation appealing. Perhaps the most important reason to automate a maintenance management program is to simplify database handling—that is, to make it easier to store, sort, and retrieve information about a building's condition and maintenance history. As time goes by, new information is generated, which adds to this database. Eventually, the amount of data will be adequate to serve as a statistically significant basis for developing preventive maintenance (PM) schedules and predictive restoration (PR) planning, (which will reduce the number of unplanned repairs).

An important feature of any computer application is its report generating capabilities. Flexibility is a desirable feature as it allows each installation to tailor reports to their particular needs. The capability to make historical comparisons is a necessity for the proper management of historic facilities.

Five areas are well suited for the application of automated systems:

1. work order management
2. work scheduling
3. inventory control
4. management of facilities inspection
5. computer-based modeling.

Work Order Management

Automated systems for work order and inventory control are well developed and readily available. More than 50 such systems are commercially available. Most can generate and track work orders, maintain and update parts inventories, schedule maintenance, and produce a variety of reports.

Generally, work orders can be categorized under repairs, preventive maintenance, building layaway, or natural disaster planning. Most available work order management packages allow differentiation between types of work orders.

Work orders are usually quite similar, regardless of what kind they are. A work order normally identifies the location; describes the activity, asset, component or piece of equipment requiring service; specifies an expected completion date; assigns the task a priority; and specifies the craft or trade involved. Typically, a work order will note an estimated and actual work time, and the form has a place to record the materials and quantities used (as shown in Figure 4).

Each item on the work order constitutes a piece of information within a database. Each piece of information can be entered into a computerized database system. When recorded in this format, the work orders can be tracked easily and statistically analyzed. For example, procedures, tools, and equipment needed for various jobs can be stored in the database as part of a library. Information from this library can be sorted to help create plans and projections of future resource requirements.

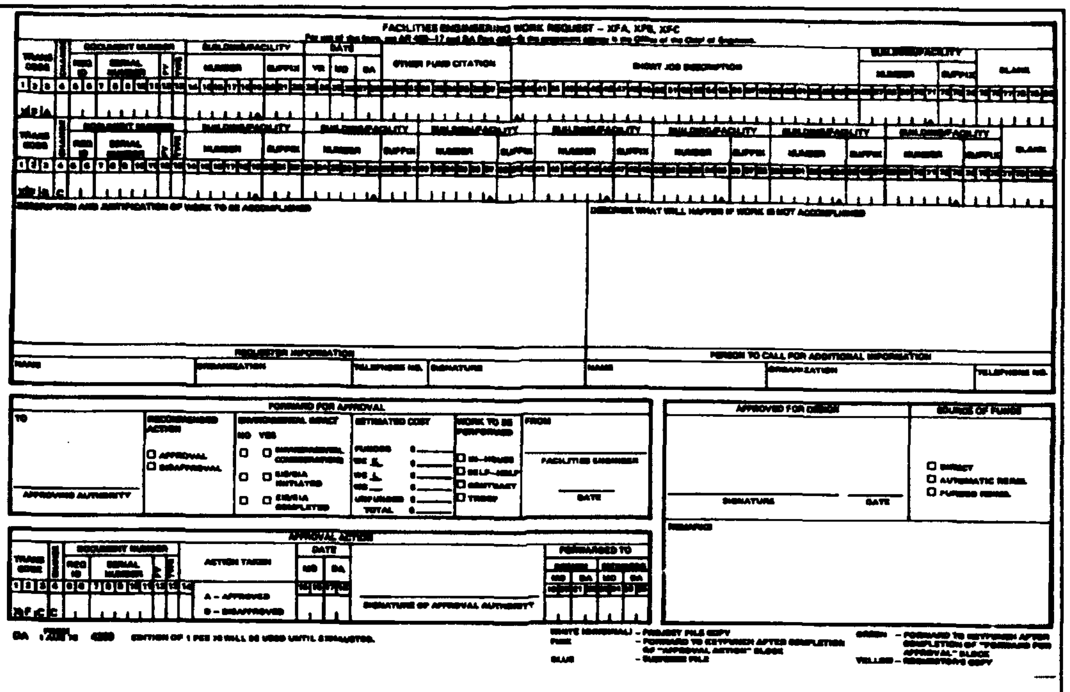

Figure 4. DA Form 4283 Facilities Engineering Work Request.

Work Scheduling

An automated system can be used to evaluate past maintenance records for forecasting PM needs. The system could schedule labor and materials for pending work orders along with resources required for PM, building layaway projects, and natural disaster planning programs. While it is inherently impossible to schedule emergency repairs, the disruptive impact of such work can be reduced through preparation based on trends in recorded historical needs.

Inventory Control

Because manufacturing facilities are the largest users of maintenance management software, most commercial computer applications are geared toward maintenance of machinery. However, an important component of maintenance management software is inventory control—capabilities designed for tracking the stock of equipment, spare parts, materials, and supplies—and there is no reason these capabilities cannot be adapted to tracking historic building inventories.

Any computer system designed for tracking historic building inventories must have hardware and software capabilities for processing, storing, and retrieving large amounts of information. Data to be stored and reused includes facility component location, age, and remaining useful life. CRMs must also make sure that any software used for tracking historic facility inventories is compatible with other software systems already in use on the installation.

Facility Inspection Management System

Unfortunately, computerized work order management systems generally lack the capability to accommodate comprehensive facility inspections. There are few computer applications available specifically for facility inspection. Some software development companies have recognized a need in this area, however, and have recently introduced facility inspection management applications. Some historic sites have adapted commercially available database management software to inhouse maintenance management inspection programs.

The massive data collection and storage needs of an inspection program present a major challenge. Ideally, inspection management software should be able to:

1. Accept information about the character and condition of each inspected component, including descriptions of any deficiencies or defects, their location, estimated cost of repair, and a priority rating.

2. Record building component life expectancies.

3. Store and manipulate inspection data.

4. Generate reports that include component deficiencies by building, priority rating, estimated cost, and life expectancy. Ideally, reports should present information in a format compatible with budget requests and development plans for major deficiencies and capital improvement projects.

Computer-Based Modeling

Predicting long-term facility renewal and replacement costs is very difficult. Even more difficult is quantifying the impact of deferred maintenance. Both tasks depend on uncertain estimates of the service lives of dozens of building components, as well as a substantial amount of "educated guesswork" about the interaction between components and such factors as extent of use, weather conditions, environmental pollutants, level of maintenance, workmanship, and so forth. While deferred maintenance almost always results in some form of premature failure, predicting the exact nature and timing of that failure is virtually impossible.

Currently there are no commercially available computer applications specifically developed to model future maintenance or renewal costs for historic building components. However, USACERL has developed a number of engineered management systems addressing a variety of installation infrastructure components, including building components, roofs, paint, pavements, and bridges. Examples include BUILDER, ROOFER, PAINTER, and PAVER (each of which is documented in separate USACERL technical reports). USACERL's Maintenance Resource Prediction Model (MRPM) can be used to project maintenance resource requirements based on material life cycles. These systems were designed to enable personnel to be more proactive in planning and prioritizing installation maintenance. While none of these systems was designed specifically for historic facilities, there is no reason why any of them could not be used as tools in a proactive historic maintenance program. It should be noted, however, that successful application would require input on estimated building component life cycles and estimated future replacement costs.

3 Preventive Maintenance

Description

Preventive maintenance (PM) is a systematic and routine maintenance process designed to extend the useful life of building materials, components, and systems. Through regular servicing and minor repairs, PM extends a building's useful life by interrupting the natural process of deterioration. Examples of PM include routine tuckpointing of masonry walls, routine cleaning of roof gutters, and the seasonal pruning of vegetation around structures.

PM is a proactive approach because it detects problems in materials and components before complete failure occurs. Such an approach not only preserves building materials—an important concern for historic facilities—but has also been proven to be cost effective. Figure 5 shows how PM fits into the PMP. Note that inventory and condition assessment information must be updated after performing PM activities.

In theory, a well maintained building can exist and function indefinitely. In practice, however, buildings do deteriorate over time. Not all building component failures can be anticipated, much less prevented. Buildings experience random failures and deficiencies that no amount of planning or careful monitoring can prevent. Therefore, PM alone is not the sole answer for the care of historic buildings. However, when major building repairs or restorations are required, the true value of regular, scheduled PM is seen (Matulionis 1991).

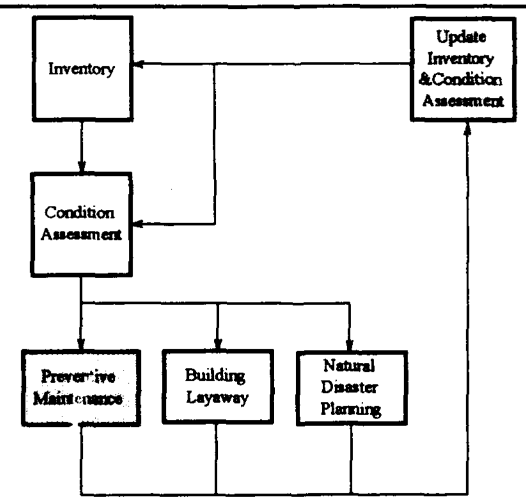

Figure 5. Preventive Maintenance Flowchart.

Predictive Restoration

Because historic building materials are in a continuous process of change and deterioration, predictive restoration (PR) is a necessary part of PM. PR is the process of estimating the serviceable lifespans of historic building components, materials, and systems, and—ideally—replacing components just before they fail. Data for these estimates come from building inspections, servicing and repair reports (work orders), and the professional experience of those involved in the estimation process.

The aesthetic qualities and architectural elements of a historic building are integral to the structure itself. Building restorations should blend with, and be subordinate to, the original structure. Original windows, doors, woodwork, panels, etc., are important to the architectural character, and are examples of craftsmanship and technology of earlier times (Technical Manual [TM] 5-801-2). Therefore, PR is intended to preserve a building's aesthetic qualities and architectural elements. Through the planned replacement of failing building materials, PR reduces the facility manager's temptation to replace historic building materials with nonsympathetic or inferior materials. PR planning also allows time for the procurement of hard-to-find historic replacement building materials, or materials that need a long delivery lead time.

Repair

Despite the best PM efforts, defects in building materials, methods, and design can cause premature failures. Building repairs will always be a part of maintenance programs. The key to a successful maintenance program is to reduce and prevent repairs.

Building repair may be defined as the allocation of resources to restore a failed building component. It is typically necessary due to neglect or deferred maintenance. Repairs—in a sense, a form of crisis management—can be frustrating because they often require immediate action and a redirection of resources, which reduces productivity in other areas.

Building component failures can cause the permanent loss of historic building elements, damage a building's contents, and injure its occupants. Some high-priority building maintenance and repair areas include roofs, exterior masonry surfaces, foundations, and mechanical systems (heating, cooling, electrical, and fire protection).

Figure 6 illustrates the effects over time of building deterioration and repair costs. The graph represents three types f building maintenance: no maintenance, deferred maintenance (repairs), and preventive maintenance. All three maintenance approaches have the same initial effect on building deterioration and repair cost, as shown in Figure 6 As time passes and minor failures begin to occur, the costs and impacts of the three approaches begin to differ. Under PM, minor failures are treated at a nominal cost as shown by the short line representing repairs. When the repairs are made, the building is back to a normal wear condition, and building life has been extended.

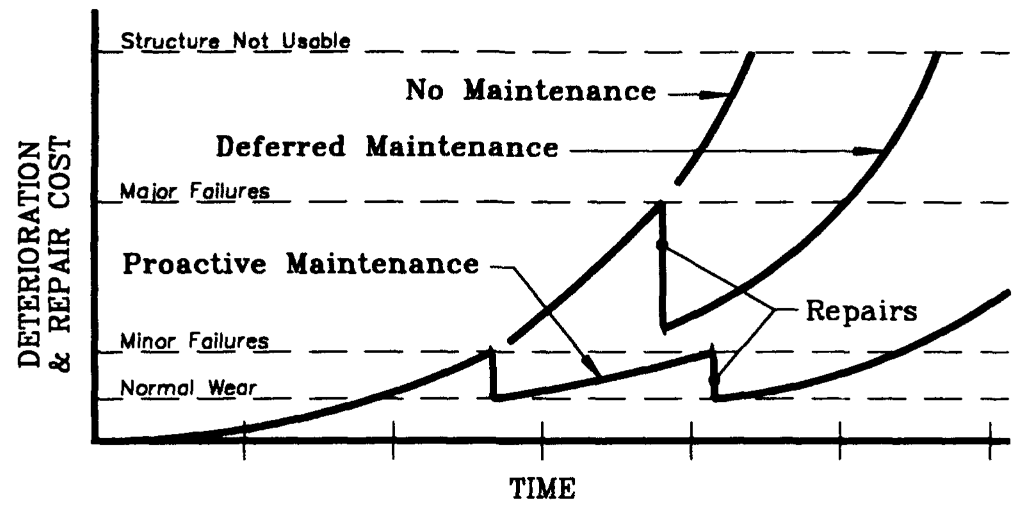

Figure 6. Effects of Maintenance on Building Life Expectancy and Life-Cycle Cost.

Ignoring the minor failures eventually leads to major failures. In deferred maintenance, big repairs are made at big expense. In many cases, normal building activities must be restricted while repairs are made. Productivity of building users is cut back. Additionally—and most importantly—historic materials are lost forever. And because the minor failures are not addressed under deferred maintenance, the building never reaches the point of normal wear. Building life has been extended as long as resources are available to react to all major failures. This approach is not practical in a time when military maintenance budgets are shrinking.

No maintenance results in the lowest maintenance cost, but these buildings become unusable within a few years. This approach leads to the highest replacement cost and loss of historic material.

Inventories and Condition Assessments

HBIs provide information and data that can be highly useful in managing a PM program. Chapter 2 discusses HBIs in more detail.

A building CA report, as discussed in Chapter 2, is essential to correctly plan and manage PM. Once the physical condition of a building's materials, components, and systems is known, a CA report can be used to help assess the annual progress in PMP activities.

Inspection and Diagnosis

Aggressive annual inspection programs help to identify signs of building problems. Inspection programs should be flexible, thorough, and tailored to the installations they serve. Written inspection guidance should include detailed checklists that show users what, where, and how to inspect historic buildings. A valuable resource for compiling inspection guidance is *Maintaining Historic Buildings: An Annotated Bibliography*, Kaye Ellen Simonson, ed. (National Park Service, 1990).

In addition to annual inspections, general surveys should be made, as necessary, especially after violent storms, large-facility use events, or changes in building use. This will help reveal damage early and prevent related failures in other historic building materials.

Proper diagnosis of building problems reveals their root causes. Identifying root causes is essential because, if not corrected, they will continue to deteriorate and accelerate the degradation of related historical building components. Such degradation will not only inflate future maintenance and repair costs, but may seriously diminish a building's historic character. Early detection and repair of failures will help preserve the historic nature of building components, avoiding their unnecessary deterioration and loss (Uzarski 1991).

In most cases the failure to conduct routine inspections and PM results in damage to historic buildings. Early repair of failing historic building components is critical to prevent irreversible damage.

Guidance for Repairs

Ideally, historic buildings should only require preventive maintenance, but building failures do occur. When the root causes are diagnosed, repairs should follow with the least possible amount of intervention. Repairs to masonry, wood, and metals may include patching, piecing, piecing-in, splicing, consolidating, reinforcing, and upgrading—all according to recognized preservation methods.

Repairs may also include limited material replacements. Ideally, extensively deteriorated or missing building materials, components, and systems (e.g., brackets, dentils, steps, plaster, slate, tile) should only be replaced with same materials. Because this approach is not always technically or economically feasible, in-kind compatible substitute materials can be considered under certain well defined circumstances.

Temporary Repairs

Temporary repairs are intended to preserve historic integrity and keep buildings watertight until permanent repairs are possible. A temporary repair should last 60 to 90 days, which allows enough time to properly plan and execute permanent repairs. It is essential to avoid using temporary repairs as if they were permanent solutions.

Temporary repairs must be made with materials that are easily removed and do not damage historic components. For example, temporary repairs can be made with tarpaulins, plywood, felts, or other materials that will not permanently affect the historic nature of the building. Patching materials like roofing cement should not be applied—they are difficult to remove and detract from the historic nature of the roof. Temporary repairs also tend to alter historic aspects of a building, but only temporarily.

Do-Nothing Approach

Doing nothing is not a form of repair, but a decision to refrain (at least temporarily) from making repairs. One possible reason for doing nothing is to observe the building failure, for a time, to determine the root causes and corrective actions needed. Often, a fine line exists between doing nothing and deferring maintenance. Care must be taken when making these decisions. Either approach used inappropriately can cause great damage to irreplaceable historic building components, and possibly even endanger building occupants.

Facilities Pathology

Facilities pathology is a methodology for the inspection and diagnosis of building failures that is currently under development by USACERL. This methodology focuses on how building components work together and affect one another. Building failures are assessed and diagnosed to reveal their root causes, and appropriate corrective actions are identified (see Figure 7).

The pathology process uses illustrated material failures and components charts (Figure 7a) to help identify symptoms of building failures. The process assumes that if no symptoms are found for a specific material or component, there is no problem. The inspection then moves to the next component. The inspector answers a series of questions to categorize material failures under one of twelve headings. When a failure is identified, the inspector then progresses through another series of questions that specifically identify the cause of the failure. These questions are contained in a set of facilities pathology flowcharts (Figure 7b). The process concludes when an answer reveals a failure's root cause. From the results of this pathology process, the inspector generates a condition analysis report (Figure 7c) that compiles the answers to the questions, summarizes the pathology results, and prioritizes the failures to be addressed.

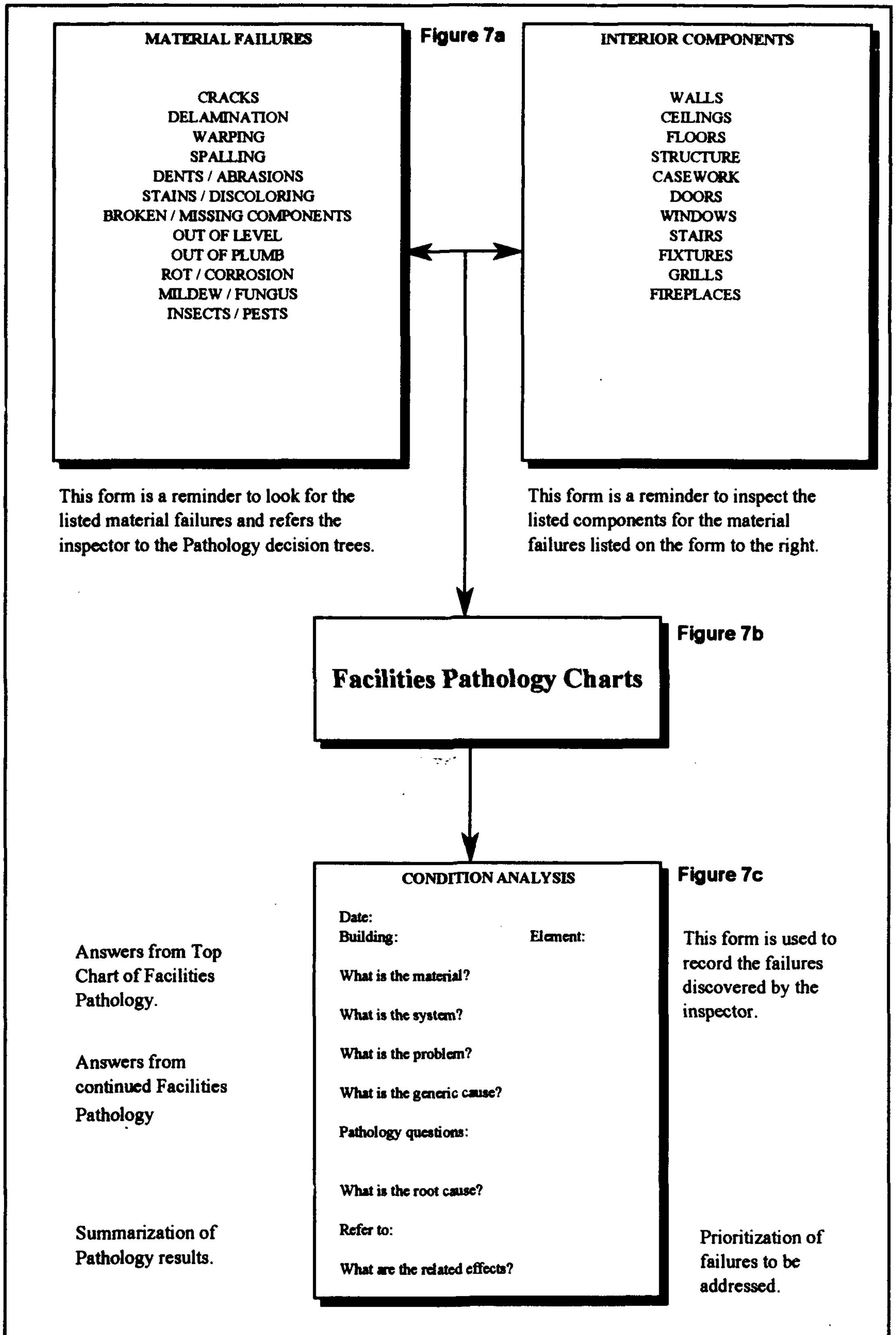

Figure 7. Facilities Pathology Flowchart.

Scheduling

Based on a detailed analysis of PM at several Army installations, it can be concluded that the programs are working very well. As funding levels decrease, however, more work must be accomplished with fewer resources (Hicks 1990). It is reasonable to assume that this statement holds true for all the military services.

Little uniformity in maintenance scheduling exists among military installations. Many installations schedule maintenance according to perceived requirements, managers' personalities, and local traditions. Differences appear in the tasks performed, priority systems, organization structures, and recordkeeping procedures. Each installation has a unique set of task codes or descriptions. Some do not perform inspections, others perform inspections but charge time to repair activities, and others perform and charge for inspections. Miscellaneous and nonproductive time charges are handled in different ways (Hicks 1990, p 30). While the organization of installation maintenance shops and crews varies widely, most include a team specializing in preventive maintenance. An installation's emphasis in PM is usually represented by the skill level of team members: higher skill levels promote PM efforts (Hicks 1990, p 16).

The differences in maintenance approaches among military installations can be thought of in terms of a spectrum. One side of the spectrum represents installations that maintain facilities by only repairing building failures. The other side of the spectrum represents installations that perform extensive PM and, in doing so, significantly reduce the occurrence of building failures. Proactive maintenance for historic buildings strongly favors the PM side of the spectrum. Most military installations, however, fall somewhere in the middle.

The purpose of this section is not to prescribe PM scheduling procedures, but rather to discuss scheduling issues and considerations relevant to the care of historic buildings.

There is no reason these interests cannot be incorporated into the scheduling of existing installation maintenance programs. A good way to prioritize the scheduling of historic building repairs is as follows:

1. life-safety and structural stabilization
2. root cause of failures
3. building weather envelope
4. related effects
5. finishes.

The correct repair of inherent building failures is the best place to start maintaining and preserving a historic building. These are failures resulting from errors made during a building's original design or construction. Many such building repairs would exceed the limits of PMP and the scope of this report, but such corrections can greatly enhance the subsequent impact of PM.

A particular problem for historic buildings is that PM generally is not given priority, but is delayed while workers are assigned other tasks. Managers generally lack information necessary to identify the most cost-effective activities for establishing priorities (Hicks 1990, p 30). Deferring PM in the short term can diminish the quality of services in a historic building. In the long run, deferring PM will shorten the life of irreplaceable historic components and escalate costs when repairs finally are made.

4 Building Layaway

Description

Building layaway programs are included in a PMP because many military installations are scheduled to close or to be reduced in size by the Base Realignment and Closure (BRAC) process. Figure 8 shows where building layaway fits into a PMP.

At installations scheduled to close, main historic buildings will be transferred to other organizations, either public or private. Some may be retained by DoD for possible future use. Buildings that are to be retained must be laid away—assigned an inactive status that prevents deterioration and makes cost-effective future reactivation possible. Even buildings to be transferred to other owners may need to be laid away due to long signover periods between vacancy and reoccupation (Hunter 1992, p 7).

Building layaway is defined as an undertaking to prepare a building to be closed. The layaway may be:

- for an indefinite period of time, during which the building will be maintained in anticipation of future occupancy by the Government or a private organization

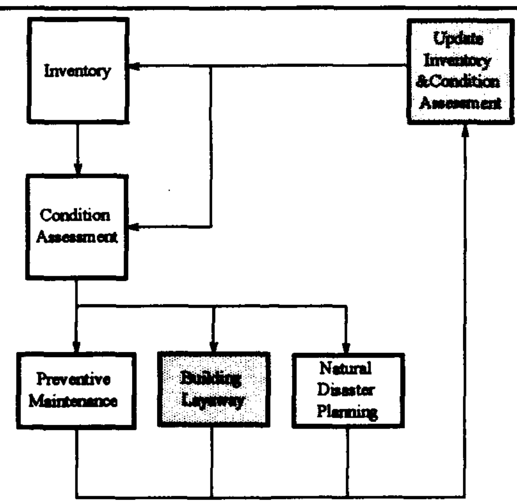

Figure 8. Building Layaway Flowchart.

- for a specified period of time, during which the building will be maintained for reactivation or transfer to a new owner
- with no future plans for reuse, and with no funds allocated for inspection, maintenance, or repair (Hunter 1992, pp 15-16).

Inventory

At the time of a historic building's layaway, HBIs are reviewed and updated. While buildings are laid away, HBIs are used to track historic building features and contents. At the time of building reactivation, HBIs are again reviewed to confirm that historic features and contents are still in place. HBIs are discussed more fully in Chapter 2.

Condition Assessment

CA reports are an essential administrative tool in building layaway programs. Throughout a layaway, CAs are used to record and monitor changes in the physical condition of historic materials, components, and systems.

Deactivated historic buildings require continual CAs in the following areas:

- ventilation
- security
- environmental concerns
- building services.

Ventilation

When a building is laid away, its doors and windows are closed and sometimes covered with plywood. Its mechanical systems are shut down. Consequently, passive building ventilation—including attic and basement spaces—becomes increasingly important. Passive ventilation takes advantage of natural airflow. Louvers installed in windows function as vents, but keep out rainwater, insects, birds, and vermin (Figure 9). If the building is to be heated and ventilated mechanically in the winter, louvers need to be installed to allow easy removal so the windows can be closed.

The National Park Service has found that proper ventilation helps to preserve historic interior finishes (Fisher and Vitana 1985). Air movement throughout the building creates an equilibrium between interior and exterior humidity levels and temperatures (Hunter 1992). Proper ventilation helps to prevent fungal growth, condensation, and odors inside the building.

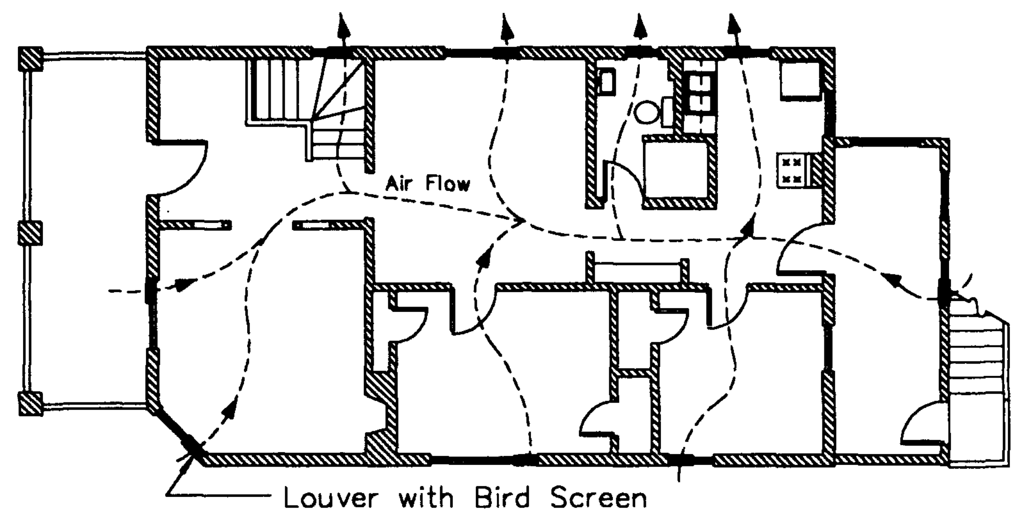

Figure 9. Sample Passive Ventilation Plan.

Security

The three types of security threats associated with deactivated buildings are vandalism, vagrancy, and theft. The key to minimizing these threats is to keep unauthorized individuals out of the area. Access roads into the deactivated historic areas can be barricaded. Signs can be erected, designating the area off limits. Security patrols should check buildings for signs of forced entry, vandalism, or vagrancy approximately three times per shift. The ladders leading to the roof, roof hatches and openings, utility openings, and fire escapes all should be secured with an approved locking mechanism. Materials stored in these buildings should be arranged in a neat, uniform manner so the guards can readily detect any disarray at a glance. These measures are the most economical and should provide adequate protection of the deactivated area.

Automated monitoring systems in combination with periodic facility site visits by staff and police are effective in providing immediate notification of building condition, fires, and security problems. Uzarski (1991) documents the successful use of an inexpensive system that allows installation personnel to monitor for building flooding, intrusion, power failure, interior temperature, humidity, failed sump pumps, or other critical components.

Environmental Concerns

Many different environmental concerns must be addressed in the layaway of a historic building. The most typical include underground storage tanks that supply fuel oil to the heating system, friable* asbestos, and lead-based paint. These materials are inherently

*friable: brittle and easy to disintegrate.

hazardous and must be addressed appropriately. The historic aspects of a building may make some environmental problems more difficult to address than they are in nonhistoric buildings. For example, removal of friable asbestos from a historic building may be required by environmental regulations. However, removal options may be restricted (or very expensive) due to the impact of removal on the building's historic character. If the building were potentially eligible for the National Register of Historic Places, and if the impact of asbestos removal would adversely affect the building's historic character, the agency that owns the building would probably be required to seek public comment on the action under Section 106 of the *National Historic Preservation Act*. Negotiations on impact mitigation (with the State Historic Preservation Office) may be required (Enscore, August 1993).

Building Services

During a building's layaway period, some building services must be retained, but others are optional. Generally, the electric service is retained to power sump pumps, security alarm systems, and other critical functions. Examples of optional services include power for exterior security lighting and interior lights to aid in inspections. Water, gas, steam, and unused communication systems (e.g., telephone, cable television) usually are disconnected. It is also important to remember that a building's plumbing systems must be drained and dried to prevent freezing and internal deterioration of equipment and piping.

Inspection and Diagnosis

The layaway process for historic buildings consists of three phases: (1) deactivation, (2) periodic inspection, and (3) reactivation. Each phase requires an aggressive building *inspection program*. As noted earlier, early detection of problems prevents future building failures and the loss of irreplaceable historic building components.

Deactivation

Inspections during this phase identify critical building repairs that must be completed before the building is allowed to stand vacant. Emphasis is placed on identifying historical component distresses that if not corrected, will begin, continue, or accelerate degradation of other historical components during layaway. Such degradation will not only inflate the cost of future maintenance and repairs, but may seriously diminish the historic character of the building. Examples of critical building repairs include:

- stabilizing the facility
  - — repair or control damage that would escalate over time
  - — secure loose doors and shutters
  - — close building openings where vermin or birds could enter and nest

- weatherproofing the facility
  - make sure that water drains away from the building properly
  - secure roof, gutters, and downspouts
  - repair damaged flashing
  - install chimney caps, if needed
  - make sure basement drains are in good working order.

Periodic Inspection

The purpose of periodic inspections is to reveal any distresses that have occurred since the last inspection. They also provide an opportunity to evaluate and monitor the effectiveness of maintenance programs while a building is deactivated.

Semiannual inspections are recommended for deactivated buildings. This frequency is recommended because failing historic building components have a rising risk for rapid deterioration if not detected within 1 year.

Deactivated buildings should also be inspected before and after violent storms, extreme changes in outside temperature, area flooding, and area activities that could affect facility condition. Any damage discovered should be repaired immediately.

Some defects discovered during periodic inspections are of the type that the building owner would normally defer until reactivation. But depending on the severity or rate of degradation, some of these will require immediate attention. Inspector judgment on reporting such deficiencies for corrective action must prevail.

Detailed checklists that show users what to look for in historic building distresses during deactivation, layaway, and reactivation are available in two USACERL reports: *Layaway Procedures for U.S. Army Facilities: Inspection, Maintenance, and Repair of Historic Building* (Hunter 1992) and *Layaway Procedures for U.S. Army Facilities, Volumes I and II* (Uzarski 1991).

Reactivation

Inspection at this phase identifies all defects that must be corrected at reactivation. This will ensure that the facility maintains a maximum degree of functionality, in terms of both quality of life and historic character.

Scheduling

Scheduling of historic building layaway programs is done in accordance with overall installation needs. Preventive maintenance and building repairs performed before, during, and after layaway are scheduled as part of the installation's PMP. This topic is discussed in greater detail in Chapter 3.

Computer Applications for Building Layaway

The most important reason to include building layaway programs in the computer automation of PMPs is to simplify the storage, sorting, and retrieval of information. Data about a mothballed building's condition and maintenance history is essentially just as important as the same information about buildings in everyday use. A more comprehensive discussion of computer applications for PMPs is presented in Chapter 2.

5 Natural Disaster Planning

Description

Natural disasters present an enormous ongoing risk to historic buildings and their contents. However, disaster planning can reduce the disaster's destructiveness and aftermath on historic buildings. When a disaster occurs, preparation can pay off in saved lives and reduced building vulnerability. Planning ahead also helps to reduce repair expenses and minimize recovery time. Figure 10 shows where natural disaster planning fits into a PMP.

Disasters caused by humans (fire, chemical spills, etc.) are covered in a military installation's safety and security protocols. Natural disaster planning for nonhistoric facilities generally focuses on the safety of the occupants. Disaster planning for historic facilities, however, must consider damage mitigation to the building and its equipment. Although the relative rarity of natural disasters may make disaster planning seem less than a top priority, the opposite is actually true (Nelson 1991):

> Those responsible for caring for cultural resources have a responsibility to develop firm policies to protect those resources in times of natural disaster. Much can be done to minimize damage to historic architecture and museum collections resulting from a disaster

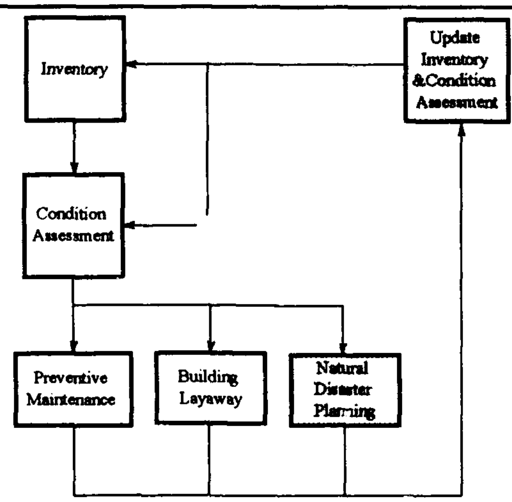

Figure 10. Natural Disaster Planning Flowchart.

with planning and prudent actions. To do less is to fail in the responsibilities we have accepted and to treat our heritage with callous disregard.

A natural disaster plan for historic buildings has two goals (Nelson 1991):

1. To create a contingency plan for when disasters strike or are imminent.

2. To develop long-term actions that will minimize the impact of an anticipated disaster. The second goal is discussed in greater detail in Chapters 2 and 3.

Preliminary Assessment Questions

In creating a disaster preparedness plan the following questions must first be answered:

- What kinds of disasters are possible and most likely in the given location?
- Whose input is needed to develop a disaster readiness plan?
- How can the plan be communicated effectively to all participants?
- Who governs policy? Who sets a plan in motion? Who is second in command?
- How should resources, people, and supplies be organized?
- What are the most important things to save?

Planning Process

The following systematic planning process for natural disaster preparedness plans is adapted from Chapter 10 of the National Park Service *Museum Handbook, Part I* (NPS, September 1990).

1. Assign responsibility for planning.

A chief executive or director can be the disaster coordinator. It is more effective however, to appoint a staff person to prepare the plan because of familiarity with everyday procedures, and because the staff will ultimately be responsible for implementing the plan.

2. Gather planning tools.

Installation reference information should be collected. Such information can be found in the installation's HBIs and CA reports (see Chapter 2). Additional information can be gathered from local and national disaster agencies. Model disaster plans of similar installations, organizations, and cities should also be collected.

3. Contact local protection agencies.

Disaster coordinators should contact police, fire, and emergency agencies to let them know about potential needs in an emergency, and also to determine the extent to which agencies will be able to respond when faced with a large disaster.

4. Identify hazards and threats.

Hazards should be systematically identified and analyzed (using CA report and HBI information) to determine which ones may be threats, and to assess damage risks. Priorities for dealing with all hazards and threats should be set.

5. Identify and set priorities for historic resources.

Historic resources should be surveyed and inventoried. If a PMP is already in place, the HBI and CA report can be integrated into the natural disaster plan. From this information, resources can be prioritized. Prioritization focuses attention on the most vital resources as a disaster develops—and especially afterward.

6. Formulate protection methods.

Actions to prevent complete losses, to reduce others, and generally prepare for a response during an emergency should be developed. These actions can be included with preventive maintenance objectives (see Chapter 3). This step also includes setting priorities for recovery and determining what outside resources and supplies will be needed to cope with the disaster.

7. Plan for command and control.

A disaster plan will change an institution's priorities and methods, but not its organizational structure. Preparations should be made to go into an emergency operations mode using the existing structure and chain of command. The emphasis should be on flexibility, innovation, and streamlined operations. Examples of this could be the designation of an alternate emergency worksite (a construction staging, a temporary shop, a place to store tools and materials, etc.).

Plan how to organize and work with volunteers, who will show up to help after a disaster.

8. Write the plan.

The characteristics of a well-written disaster plan include flexibility, simplicity, and adaptability. Identify emergency priorities, needed resources, and sources of assistance.

9. Train staff how to use the plan.

Training helps to ensure that personnel will act automatically in an emergency rather than waste time trying to figure out what they should do. It helps each person become familiar with his or her responsibilities so duties can be handled without confusion or panic when a disaster strikes.

10. Test the plan.

The first test should be made while the written plan is still in draft. After the plan is adopted, periodic drills will indicate if it functions as intended. Whenever a test reveals deficiencies, the plan should be revised.

11. Evaluate the plan.

If a disaster strikes, analyze how well the plan worked. Assess its components and the performance of all participants with written records and photographs. Solicit opinions from everyone involved through interviews and meetings.

12. Keep the plan current.

The disaster plan should be reviewed regularly—every 3 to 6 months and never less than once a year. Carefully record amendments by noting the dates of changes, the nature of change, and the pages of the plan affected. Maintain a list of plan holders to notify as changes are made. It is essential to keep names and telephone numbers current and to ensure that new staff are included in preparations. Review the plan with emergency management officials, and make sure they have a copy. Ask to be included in installation emergency exercises.

A Representative Disaster Plan

A typical disaster plan has five components (Hunter 1986). The contents may differ from site to site and building to building. The five components discussed on the following pages can be adapted to meet the needs of any installation.

1. Introduction and Statement of Purpose

   This section states why the plan was written, who developed it, and how it is to be kept current.

2. Authority

   This section documents who will direct the plan's preparation and who will implement it.

3. Scope of the Plan

   This section itemizes the events planned for, in priority order, types of emergencies expected, likely occurrences, and expected impacts. The scope section specifies the applicable locations and sites covered, and under what circumstances. (Alternatively, separate plans can be developed for multiple sites.) The scope section also explains how the plan relates to other documents: how an installation's supplemental plans (fire protection, security, health emergency, etc.) relate to one another, as well as how the plan relates to local and state disaster plans.

4. Emergency Procedures

   This section may be divided into subsections on disaster avoidance, mitigation, response, and recovery. Potential disasters should be addressed in terms of what to do before, during, and after. This section should also describe who puts the plan into action, under what circumstances, and how responses are to be implemented.

5. Appendices

The appendices include information specific to the plan that is likely to require periodic updating. Typical examples include:

- staffing and organizational charts
- organizational chart of relationships to other institutions and public disaster agencies
- chart of disaster control responsibilities
- key personnel responsible for executing the plan, with names, titles, addresses, office and home telephone numbers, and duties
- instructions for contacting outside personnel and organizations, such as police, fire departments, utilities, hospitals, repair companies, insurance agents, and technical experts; notes about why each is listed and services offered; and contingency plans for when communications lines are down or overloaded
- maps and floor plans showing evacuation routes, locations of utility cutoffs, telephone closets, firefighting equipment, emergency supplies, and related items; these can be integrated into HBIs and CAs
- HBI and CA reports, plus floor plans for quick location of assets in an emergency (but omit the floor plan in backup copies stored offsite so it does not become a burglar's shopping list)
- summary of arrangements to relocate or evacuate collections, including persons to contact and the alternative safe locations
- instructions for emergency operation of utilities and building systems (also to be included in HBIs)
- list of emergency supplies and equipment, noting location, what they are to be used for, and who is to use them; include information on borrowing or buying additional items
- information on who is to provide transportation for emergency supplies, equipment and personnel, including alternative arrangements
- names and telephone numbers of experts such as conservators, architects, and contractors who can be called for assistance
- glossary of terms used in the plan (so everyone speaks the same language in an emergency).

Disaster plans should be kept in a ring binder. The original plan should be placed in a safe, fire-resistant, and waterproof location. Include any supplementary information needed in an emergency. Copies of the plan should be given to all key personnel responsible for its execution. It may be a good idea for emergency coordinators to have disaster plans on computers so information can be updated and distributed quickly. If the plan covers more than one site, copies should be placed at each site.

Sample Disaster Plan

Figure 11 presents a condensed version of a disaster preparedness plan written for Ashton Villa, TX, on Galveston Island. This plan focuses on preparing for and recovering from hurricanes because Galveston Island is vulnerable to them.

The Ashton Villa Disaster Plan addresses the possibilities for flooding, leakage through roofs, windows and doors, damage from flying objects during high winds, and possible staff disorganization both before and after a hurricane. The plan is composed of four basic parts:

- assessment of vulnerability
- prestorm preparations
- recovery
- appendices of vital information (subject to change)

By documenting the Ashton Villa Disaster Plan in writing, it can be implemented more quickly during a disaster. With emergency instructions defined, the impact of a disaster should be reduced. The town's actual plan (as opposed to the condensed version in Figure 11) includes detailed instructions and checklists, and responsibilities for all aspects are designated. The Ashton Villa Disaster Plan is reviewed by May of each year, before the start of the hurricane season.

Disaster Plan
for
Ashton Villa, Texas

I Assessment of Vulnerability

A Vulnerability Checklist (for monthly review during hurricane season). Responsibility of Ashton Villa director.

1 Roof in good repair.

2 Shutters securely hinged.

3 Shutter locks in good working condition.

4 Trees trimmed and healthy.

5 Staff aware of recommended procedures outlined in this plan.

6 Emergency supplies available and in working condition.

B Vulnerability Assessment (what storm is imminent). Responsibility of Ashton Villa director.

In order to allow ample time for staff evacuation from the Island, should it be advisable, and in order to allow adequate preparation time, the director must assess the intensity of the impending storm and the time projected for landfall. Having made this analysis, the director must make a decision regarding starting time, extent of protection needed and completion time for the procedures outlined in this plan.

The Ashton Villa director is first in responsibility and has final authority in this matter. In the director's absence, the assistant director has this responsibility.

II Prestorm Preparations

A List of Museum Assets to Be Protected

Assets	**Responsibility**
Staff	Director
Volunteers	Head Tour Guide
Visitors	Head Tour Guide
Clients	Assistant Director
Administrative Offices	Director/Assistant Director
Archeological Area/Gift Shop/ Theater/Exterior/Ballroom	Head Cashier
Collection Director/Assistant	Director/Museum Site Assistant
Apartment	Tenant

Figure 11. Disaster Plan for Ashton Villa, TX.

B Materials

1 A file containing written materials relating to Gulf Coast hurricanes is available to staff and volunteers. The file, labeled "Hurricanes," is kept in a fireproof file cabinet in the center office. Responsibility of assistant director.

2 Weather radio is kept in safe in administrative office. Responsibility of assistant director.

3 Phone rosters and other information subject to change and update are attached to this plan in the form of appendices. Responsibility of director.

4 Emergency materials related to the security of collection, museum interior and building exterior are stored in a designated area on the third floor. Responsibility of museum site assistant.

5 Shutters for administrative office windows are stored in gift shop closet (upper half-accessible by narrow, high doors on east wall, south side of room). Responsibility of assistant director.

C Storage Space for Collection

If the severity of the storm is judged by the director to warrant removal or storage of the collection, artifacts original to Ashton Villa will be given first consideration. Extensive storage is generally unwarranted. The director will decide on extent of security. Should storage be necessary, Appendix 8 will serve as a guide. Appendix 7 is a list of original Ashton Villa artifacts and their exhibited locations.

Figure 11. (Cont'd)

Director's Responsibilities Checklist

1 Make decisions regarding extent of vulnerability, immediacy of need and timetable for starting and completing process.

2 Direct all disaster plan activities.

3 Communicate with Galveston Historical Foundation headquarters associate director for museums, and executive director, regarding plans.

4 Advise associate director for museums if Galveston Historical Foundation staff support is needed.

5 Relate decision regarding plans to Ashton Villa Committee chairman.

6 Inform of closing (see telephone numbers in Appendix 1):
   Ashton Villa Gardener
   Ashton Villa Museum Site Assistant
   Ashton Villa Custodian
   ADT (fire alarm system company)
   Alert Alarms (security alarm system company)
   Apartment tenant
   Galveston Police Department

7 Check appointment calendar and advise where necessary.

8 Store active files in fireproof file cabinet.

9 Prepare a final report for Ashton Villa Committee file.

Make three copies of this checklist, include with other checklists in packets to: Ashton Villa Committee chairman, Galveston Historical Foundation executive director and Galveston Historical Foundation associate director for museums.

Make final check of site security.

______________________________ _______________

Director's Signature Date

Figure 11. (Cont'd)

Assistant Director's Responsibilities Checklist

1 Telephone to inform of closing:
Galveston Historical Foundation Public Relations Department
Strand Visitors Center
Convention and Visitors Bureau
Ellissa
Williams Home
All scheduled group tours
All paid tour guides
All volunteers
All ballroom renters affected by closing

2 Secure kitchen and gift shop (if cashier and head tour guide are on the job they may assume the kitchen and gift shop preparatory duties):
Clean kitchen cabinets and lock.
Unplug all equipment/appliances; store smaller ones in cabinets.
Store cash register in kitchen cabinet and cover with plastic.
Protect projectors by wrapping in plastic bags and store in kitchen cabinets.
Turn off all heat/air conditioning in carriage house and kitchen.
Clear gift shop of all items and store off the ground, if possible.
Clear brochure racks and store on high shelf in cashier's closet.

3 Secure administrative offices:
Unplug all equipment/appliances and cover with plastic.
Move computer and related equipment away from windows and cover with plastic.
Store architectural rendering and floor plans in entrance hall closet.
Clear all surfaces, storing as much as possible in desk drawers or cabinets; secure other materials in plastic bags and place under desks.
Tape supply cabinets and file drawers shut.

4 Miscellaneous duties:
Balance all cash, keeping $50.00. Deposit all other cash, checks and/or credit card vouchers.
File all active files, letters and attendance records in fireproof cabinet.
Take mail to post office.
Secure docent information and master roster.
Secure all information regarding tours and rentals in fireproof cabinet.

Make three copies of this completed checklist. Give original and a copy to director; place a copy in safe.

____________________________ ______________
Assistant Director's Signature Date

Figure 11. (Cont'd)

Museum Site Assistant's Responsibilities Checklist

1 Confer with director regarding extent of protection needed and implement storage/security plans accordingly.

2 Hook and tie all shutters on main house, ballroom, carriage house/tack room , administrative offices.

3 Tie up all draperies on first floor of museum.

4 Unplug all equipment/appliances.

5 All furniture will be moved into the center of each room, away from windows and skylights. In case of severe storm probability, furniture may be covered with plastic for further protection.

6 All art work on walls will remain on walls unless there is probability of severe storm. Small paintings in close proximity to windows may be taken down and covered with plastic. Large paintings may be covered with plastic. Original Brown paintings will be the first to be taken down and stored in closets as near to their exhibited location as possible.

Make three copies of this checklist. Give original and a copy to the director, keep a copy, and put a copy in the files.

______________________________ ______________

Museum Site Assistant's Signature Date

Figure 11. (Cont'd)

III Recovery

A Postdisaster Communication

1 Contact Galveston Historical Foundation executive director and /or museum director as soon as possible regarding status of property.

2 Appendix 1 lists staff telephone numbers including alternate numbers for contacting the Ashton Villa director.

B Insurance

1 Policies are kept at and administered from the Galveston Historical Foundation's offices at 2016 Strand.

2 Insurance company is listed under recovery contacts. See Appendix 1.

3 A preliminary damage list must be formulated as quickly as possible and delivered to the insurance company. Responsibility of the director.

4 Only necessary temporary repairs should be made. Wait for insurance adjuster before making permanent repairs.

C Collection

If collection is damaged, immediately contact consultants listed in Appendix 1.

D Miscellaneous

1 Assess degree of danger.

2 Assess degree of damage.

3 Select methods.

4 Assign duties.

5 Inform Galveston historical Foundation office: executive director, associate director of museums and public relations director.

E Critique

1 Reassess vulnerability, methods of preparation and recovery.

2 Send written report to: Galveston Historical Foundation board of directors, c/o executive director, Ashton Villa Committee and Texas Historical Commission.

3 Revise Ashton Villa Disaster Preparedness Plan as needed.

Figure 11. (Cont'd)

IV Appendices of Vital Information

1 Telephone roster (includes staff home numbers, Galveston Historical Foundation, Ashton Villa Committee members, apartment tenant, police department, hurricane preparation specialists and recovery contacts)

2 Disaster supplies and storage

3 Storage plan for multimedia equipment

4 Sample: final report

5 Utilities and services locations

6 Plumbing diagrams

7 Ashton Villa original items list

8 Storage specifics

9 Hurricane supplies storage locations

10 Protective window covering assemblage

Figure 11. (Cont'd)

Tips for Preparing Plan

A set of planning principles suggested by one author (Boozer 1990) summarizes the goals of natural disaster planning for historic buildings. Applying these principles will help installation personnel compile the most effective natural disaster plan that is feasible.

Plan for the Worst

All planning should assume a worst-case scenario. This strategy will improve the probability of covering whatever disaster actually occurs.

Plan for all Possible Circumstances

In the case of Hurricane Hugo, emergency plans failed to anticipate the heavy rains that followed 2 days later. In California, earthquake-response plans for historic structures have not been formulated in many areas. After-effects such as flooding, drainage, rain, and fire all should be considered when developing plans.

Assume That No Outside Help or Resources Will be Available

The plan should include a directory of outside resources, but it also must enable total self-reliance. Transportation of people and supplies may be difficult or impossible immediately after a disaster.

Plan for the Aftermath

While the worst may occur during and immediately after a disaster, other serious problems may arise or continue for weeks. For example, after hurricanes and earthquakes, some areas often go without water and electricity for weeks.

Determine Who Can Help and What They Can Do

Plans should include expected work schedules. Specific task outlines should be developed.

Keep Telephone Numbers Current

Periodic updates of plan telephone numbers, or "call-up lists," are essential. A disaster phone list must include utilities, public safety agencies, key volunteers, key national or out-of-state contacts, and other resources.

Always List Stockpile Contents and Locations in Plan

Basic supplies always should be kept on hand. Water, food, cleanup supplies, emergency power gear, and protective materials should be available—either on site or close by.

Develop a List of Craftspeople and Trade Workers

As part of the regular maintenance program, prepare a list of people potentially available for disaster repair and cleanup. Make sure that they are aware of the disaster preparedness plan's contents and that their locations and telephone numbers are listed in it.

Ensure Adequate Training

Staff and key volunteers must be trained. They must know what is expected of them—especially because they may face personal crises and travel difficulties during the disaster.

Update and Train Periodically

Historical organizations and sites constantly change. The plan must change with them, and staff must be familiar with the changes.

Emphasize Ongoing Maintenance

Well maintained historic structures fare better in a disaster. Develop and adhere to a regular maintenance program.

Plan To Relocate the Most Valuable Items if Time Permits

Historic property managers may want to work out cross-storage agreements with managers in other regions, assuming secure transportation can be arranged. Depending on the type of disaster the facility is vulnerable to, a simpler approach may be better. For example, one-of-a-kind items and furniture may be moved to upper floors if the facility is vulnerable to floods.

Where tornados are a possibility, paintings can be stored in closets. Library catalogs can be shrouded in plastic or relocated. The key is to identify objects that need special protection, and to specify when, where, and under what circumstances to move them.

Do Not Ignore Financial Planning

A natural disaster can easily create a financial disaster. If possible, build contingency reserves into every budget. Disruption of normal activity into subsequent months and years can cause major financial damage.

Address Normal Programmatic Activity

The preparedness plan should present strategies for returning operations to normal. For historic places open to the public, plans should include promotional campaigns stressing "business as usual" and post-disaster fundraising efforts. Plans can be developed to keep the public away from an unsafe building without closing off an entire street or demolishing any historic structures simply to reopen a commercial area.

6 Summary

A proactive approach to maintaining historic military facilities is important to the military services in terms of economics, stewardship, and regulatory compliance. A Proactive Maintenance Plan, or PMP, addresses all three areas of concern by planning for the preparation, intervention, and control of historic building deterioration. The PMP coordinates a diverse group of preservation activities to effectively plan maintenance and anticipate building component failures.

A PMP can be tailored to each building. Flexibility is essential due to the potential assortment of historic buildings on a given installation. PMPs should be phased in and integrated with existing installation maintenance programs.

Under a PMP, intervention occurs with resources before a building component fails. Central to this approach is controlling building deterioration rather than reacting to it. Control is gained by performing preventive maintenance and *proactive restoration,* which reduces the need for—and long-term cost of—building repairs.

Historic building inventories and condition assessments are the essential management tools in the care of historic buildings. Computers can help manage the large quantities of information needed to support a PMP.

A PMP also encompasses building layaway programs and natural disaster planning. The serviceability of unused historic buildings is ensured through proper layaway procedures. Natural disaster planning mitigates damage and shortens recovery time.

DoD is the nation's largest steward of historic buildings. With effective planning, the nation's rich military heritage can be enjoyed for generations.

Annotated List of References

Cited

Chambers, Henry J., *Cyclical Maintenance for Historic Buildings* (National Park Service, 1976)

- Helped set the standards

- Preliminary report prepared under contract for the National Park Service.

- Part of a series of publications on the technical aspects of historic preservation.

- Issued in response further the purposes of Executive Order 11593, which makes the Secretary of the Interior responsible for developing and disseminating "to Federal agencies and State and local governments information concerning professional methods and techniques for preserving, improving, restoring and maintaining historic properties." (This responsibility has been delegated to the National Park Service.)

- Intended users: administrators, architects, and others involved in the preservation and maintenance of government-owned historic properties

- Organized in two parts: preparation for maintenance and maintenance techniques.

Enscore, Susan I., Dan R. Lapp, and Mira D. Metzinger, *Guidelines for Documenting Historic Military Structures*, Technical Report (TR) CRC-94/03 (USACERL, March 1994).

Hicks, Donald K., *Preventive Maintenance Program: Evaluation and Recommendations for Improvements*, TR P-90/16/ADA225884 (USACERL, June 1990).

- Evaluates the Army Preventive Maintenance (PM) Program for buildings, structures, and utilities: describes PM documentation and operating procedures; analyzes existing variations in Army performance of PM; discusses problems with PM programs; and recommends solutions.

- Looks at the quality of the existing PM data and IFS-M records, and recommends improvements.

- Discusses the Army's Self-Help (SH) Programs for family and troop housing.

Hunter, S.L., *Layaway Procedures for U.S. Army Facilities: Inspection, Maintenance, and Repair of Historic Buildings*, TR-FM-93/DRAFT (USACERL, September 1992).

- Presents interim information for historic buildings based on facility layaway research published in USACERL TR-M-91/23 (Uzarski, July 1991).

- Describes specific requirements for laying away historic buildings—guidelines for inspection, periodic maintenance, and repair for key building systems, components, and subcomponents.

- Key chapters include "The Philosophy, Law, and Special Considerations of Laying Away Historic Buildings"; "Inspection Requirements for Historic Buildings"; and "Developing Maintenance and Repair Guidelines." Included in the appendices are checklists to guide the user through inspection, maintenance, and repair of all major building systems (roofing, plumbing, utilities, etc.).

Matulionis, Raymond C., and Joan C. Freitag, eds., *Preventive Maintenance of Buildings* (Van Norstrand Reinhold, New York, 1991).

- Presented in plain language.

- Provides information and practical techniques in preventive maintenance of major building envelope systems:
  - — effective preventive maintenance measures that ensure dependable, failure-free building systems and achieve building component performance requirements
  - — economic advantages of a well-planned, cost-effective preventive maintenance program
  - — inspection methods.

- Discusses concerns of building owners, designers, maintenance personnel, and builders:
  - — detection of potential building failures
  - — necessary steps to avert premature building deterioration
  - — preventing premature building failures with good design, materials, and workmanship.

- Each chapter contains a bibliography and a list of professional associations with information on the topics covered.

- Contributors include designers, builders, researchers, and educators. Each contributor is an expert in their field and offers valuable knowledge and insights gained over many years of experience.

Museum Handbook, Part I: Museum Collections (National Park Service, September 1990), Chapter 10.

- This document provides state-of-the-art guidance on managing collections.

  — handling objects

  — environmental monitoring and control

  — museum pest management

  — storage

  — packing and shipping

  — conservation treatment

  — museum security and fire protection

  — emergency planning

  — curatorial health and safety

  — planning and programming for museum collections management

  — museum ethics

- An important feature of this document is the set of technical appendices that address the care and preservation of archeological collections, paintings, cellulose nitrate photographic negatives, and objects made of paper, textile, wood, metal, ceramic, glass, and stone.

- Additional technical appendices are being prepared to address the care of natural history collections, photographic collections, and leather and skin objects.

Nelson, Carl L., *Protecting The Past From Natural Disasters* (The Preservation Press, Washington, DC, 1991).

- Stresses planning and mitigation measures, in a nontechnical format.

- Focuses on historic buildings.

- Presents a practical guide to preparing for, responding to, and recovering from natural disasters (hurricanes, earthquakes, tornados, floods, and fires).
- Outlines process for natural disaster preparedness.
- Discusses lessons learned in 1989 from Hurricane Hugo and the Loma Prieta (CA) earthquake.
- Cites technical natural disaster publications and groups.

Policies and Procedures for Processing National Register Nominations, National Register Bulletin 19 (National Park Service, December 1987).

Ruskin, John, *The Seven Lamps of Architecture* (Century, London, 1988).

- First published in 1847 as a response to the destruction of many buildings loved by the author. The book is a Victorian social essay, and a landmark in the history of architectural taste.
- The "seven lamps" are Sacrifice, Truth, Power, Beauty, Life, Memory, and Obedience.
- Proposes that architects and society have a moral responsibility for what they build and how they build it.

Technical Manual (TM) 5-801-2, *Historic Preservation Maintenance Procedures* (Headquarters, Department of the Army [HQDA], 1 February 1977).

Uzarski, D.R., *Layaway Procedures for U.S. Army Facilities, Volumes I and II*, TR-M-91/23/ADA239849 (USACERL, July 1991).

- Describes facility layaway procedures developed for Fort Dix, NJ, and applicable to U.S. Army facilities in general.
- Volume I, *Decision Criteria and Economics*, discusses:
  - — decision matrices for choosing cost-effective layaway strategies
  - — concepts of differing maintenance and repair standards
  - — strategies for short- and long-term layaway periods

— periodic maintenance and repairs during building deactivation, layaway, and reactivation

— environmental and security concerns.

Volume II, *Inspection and Maintenance and Repair Checklists*, presents specific inspection, maintenance, and repair items covering all building and utility systems and components:

— items presented in a checklist format

— brief explanatory section precedes each checklist.

Uncited

Feilden, Bernard M., *Conservation of Historic Buildings* (Butterworths & Co., London, 1989).

- Based on the author's experience.
- Written for architects, engineers, and surveyors.
- Surveys conservation principles and their application to historic buildings.
- Provides basic information for the solution of architectural conservation problems in most climates.
- Organized in four parts: (1) Structural Aspects of Historic Buildings, (2) Causes of Decay in Materials and Structure, (3) The Work of the Conservation Architect, and (4) Building Repairs and Special Techniques.
- Appendix by R.J. Mainstone on assessment of historic buildings as structures.

Leeke, John, *Maintenance Programming Manual For Historic Buildings* (Maine Historic Preservation Commission, Augusta, ME, 1990).

- Establishes a procedure for developing a maintenance program for historic buildings.
- Helps to make effective use of resources.
- Discusses a hypothetical maintenance program model.

- Organized in two parts:
  - — Part 1 provides a background in building maintenance programming and theory.
  - — Part 2 describes the four steps of maintenance programming: (1) assess, plan, (3) maintain, and (4) evaluate.

- Appendices include sources for further information, sample planning documents based on a hypothetical historic site, and blank forms for developing site-specific maintenance program needs.

Melvin, Eric, *Plan. Predict. Prevent. How to Reinvest in Public Buildings*, Special Report 62 (American Public Works Association [APWA] Research Foundation, Chicago, 1992).

- Concludes the second phase of a joint research project between the APWA and the National Academy of Sciences Building Research Board. The first phase produced the report *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings* (August 1990). The second report builds on the findings of the first.

- Stresses the need to shift the emphasis of building maintenance from crisis management to reinvestment and planning.

- Key chapters include:
  - — Survey of Agencies and Current Practices
  - — Identifying Maintenance Needs
  - — Work Management
  - — Estimating the Costs of Maintenance Activities
  - — Planning and Budgeting for Building Maintenance
  - — Life-Cycle Costing as an Aid to Decision Making for Building Maintenance
  - — Computer Applications for Building Maintenance Management.

Stahl, Frederick A., *A Guide to the Maintenance of Historic Buildings* (General Services Administration [GSA], Public Building Service, 1980).

- Discusses common problems in deterioration and failure of building materials and systems found in most of GSA's historic buildings.

- Objectives are to:
  - — help establish a continuing program for building care that preserves the physical integrity and visual character of significant GSA properties

— assist in adapting these buildings to contemporary safety, utility, and convenience standards without disturbing their original architectural character.

- Organized to six parts:
  - — Custodial and Maintenance Information
  - — Repair, Alteration, and Design Information
  - — Materials Information
  - — Building Systems Information
  - — Mechanical Systems Information
  - — Electrical Systems Information.

Simonson, Kaye Ellen, *Maintaining Historic Buildings: An Annotated Bibliography* (National Park Service, Preservation Assistance Division, 1990).

- Includes reading list, suggestions, and information on the subject of maintenance planning.

- Reading lists have been published by the National Park Service, since 1975. Most are selected bibliographies, not intended to be a comprehensive overview of the subject. Some are annotated.

- Intended for use by architects, building owners, managers, and administrators to develop and implement maintenance plans for historic properties.

- Discusses 19th century historic housekeeping guides through more sophisticated methodologies.

Abbreviations and Acronyms

APWA	American Public Works Association
BRAC	Base Realignment and Closure
CA	condition assessment
CFR	Code of Federal Regulations
CRM	cultural resource manager
DoD	Department of Defense
FESS	Facility Engineer Supply System
GSA	General Services Administration
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HBI	historic building inventory
IFS-M	Integrated Facilities System–Minimicro
NRHP	National Register of Historic Places
PM	preventive maintenance
PMP	proactive maintenance plan
PR	predictive restoration
SH	Self-Help (Program)
TR	Technical Report
USACERL	U.S. Army Construction Engineering Research Laboratories
USC	United States Code

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